

PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference PCT400 261 AMR	FOR FURTHER ACTION See Form PCT/IPEA/416	
International application No. PCT/SE 2003/002003	International filing date (day/month/year) 17-12-2003	Priority date (day/month/year) 13-02-2003
International Patent Classification (IPC) or national classification and IPC B25J 9/16, G05B 19/4097, G05B 19/42		
Applicant ABB AB et al		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 5 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
 - a. ☐ (sent to the applicant and to the International Bureau) a total of _____ sheets, as follows:
 - ☐ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
 - ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
 - b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).
4. This report contains indications relating to the following items:

<input checked="" type="checkbox"/>	Box No. I	Basis of the report
<input type="checkbox"/>	Box No. II	Priority
<input type="checkbox"/>	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
<input type="checkbox"/>	Box No. IV	Lack of unity of invention
<input checked="" type="checkbox"/>	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
<input type="checkbox"/>	Box No. VI	Certain documents cited
<input type="checkbox"/>	Box No. VII	Certain defects in the international application
<input type="checkbox"/>	Box No. VIII	Certain observations on the international application

Date of submission of the demand 01-09-2004	Date of completion of this report 22-11-2004
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. +46 8 667 72 88	Authorized officer Ender Dag/itw Telephone No. +46 8 782 25 00

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International application No.

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Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on a translation from the original language into the following language _____ which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
- ☐ publication of the international application (under Rule 12.4)
- ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:
- ☒ the international application as originally filed/furnished
- ☐ the description:
- pages _____ as originally filed/furnished
- pages* _____ received by this Authority on _____
- pages* _____ received by this Authority on _____
- ☐ the claims:
- pages _____ as originally filed/furnished
- pages* _____ as amended (together with any statement) under Article 19
- pages* _____ received by this Authority on _____
- pages* _____ received by this Authority on _____
- ☐ the drawings:
- pages _____ as originally filed/furnished
- pages* _____ received by this Authority on _____
- pages* _____ received by this Authority on _____
- ☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing
3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing (*specify*): _____
- ☐ any table(s) related to the sequence listing (*specify*): _____
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing (*specify*): _____
- ☐ any table(s) related to the sequence listing (*specify*): _____

* If item 4 applies, some or all of those sheets may be marked "superseded."

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Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. Statement**

Novelty (N)	Claims	<u>1-36</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>1-36</u>	YES
	Claims		NO
Industrial applicability (IA)	Claims	<u>1-36</u>	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)**Documents cited in the International Search Report**

D1: US 6134506 A

D2: US 2002038855 A1

D3: "CAD-based object recognition for a sensor/actuator measurement robot"

D4: "Automated extraction of features from CAD models for 3D object recognition"

The applicant describes the problem of a computer program for calibrating an industrial robot by moving relative to defined positions on an object. Prior art discloses methods to program an industrial robot using a CAD model of the object, where the position of the robot path are received from the CAD model or by means of a laser measuring system. The object of the present application is to provide a new method and system for calibration and programming of a robot in dependence of the deviations between the measured values and the model of an object in a simple and inexpensive method, according to the applicant.

Document D1 discloses a method and apparatus for measuring three-dimensional (3-D) coordinates of an object. A probe apparatus, such as a stylus, is used to digitize three-dimensional objects into a mesh representation by a computer system. The probe apparatus senses the position and orientation of the probe and is calibrated by placing the tip of the stylus at an arbitrary point in a work volume and varying the stylus' orientation to find error values and determine calibration parameters. The sensors of the probe

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Supplemental Box

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Continuation of: Box V

apparatus are zeroed by placing the probe apparatus in the only possible home position and assigning assumed starting angles to the sensors. The mesh representation of the object is developed by the computer system by incrementally creating and displaying triangles from data points of contour lines of the mesh.

Document D2 discloses a method for compensating the position of a robot in which a laser measuring instrument is used by establishing an origin coordinate system, such that a robot teaching process time is reduced and a precision of welding point teaching is enhanced. The method determines if an error between CAD data and data modelled through simulation is less than a predetermined value, revision the data if it is not or jigs if it is, and downloading the robot teaching program to a robot controller.

Document D3 discloses a multi-sensor measurement robot which uses optical sensors and actors to identify and gauge industrial objects located in the measurement volume. The application focuses on location of the object using a camera and establishing the transformation between the robot coordinate system and a ground plate coordinate system. For recognition of the object the system uses hypothesize-and-test approach.

Document D4 discloses a measurement system using data from multiple sensors for detecting surface curvatures of an object by using a least squares surface fitting algorithm. A CAD model based object forms the basis for measurement planning and assessment of object recognition.

The difference between D1-D4 and the claimed invention is that a plurality of measuring points is generated corresponding to different points on the surface of a geometrical model of a real object expressed in a coordinate system associated with an industrial robot. A calibration module determines orientation and position of the geometrical model of the object relative to the coordinate system associated with the robot and a calculating module calculates the deviation between the measuring points and corresponding points on the geometrical model, CAD model. An adjusting module is arranged

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Supplemental Box

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to adjust defined positions based on the calculated deviations. The calibration of the robot is in dependence of the deviations between the measured values and the model for all geometric and kinematics errors. The method and system reduces the need of extra measuring equipment for measuring kinematics errors, the tool coordinate system and the object coordinate system.

Hence it is not obvious for a person skilled in the art to modify D1-D4 to solve the same problem as referred in the claimed invention.

The invention according to claims 1-36 is novel, industrial applicable and is considered to involve an inventive step.